

ABSTRACT

A man-machine interface is disclosed which provides force, texture, pressure and temperature information to sensing body parts. The interface is comprised of a force-generating device (900) that produces a force which is transmitted to a force-applying device (902) via force-transmitting means (908). The force-applying device applies the generated force to a sensing body part. A force sensor (909) associated with the force-applying device measures the actual force applied to the sensing body part, while angle sensors (917) measure the angles of relevant joint body parts. A computing device (911) uses the joint body part position information to determine a desired force value to be applied to the sensing body part. The computing device combines the joint body part position information with the force sensor information to calculate the force command which is sent to the force-generating device. In this manner, the computing device may control the actual force applied to a sensing body part to a desired force which depends upon the positions of related body parts. In addition, the interface is comprised of a displacement-generating device (901) which produces a displacement which is transmitted to a displacement-applying device (902) (e.g., a texture simulator) via displacement-generating means (920). The displacement-applying device applies the generated displacement to a sensing body part. The force-applying device and displacement-applying device may be combined to simultaneously provide force and displacement information to a sensing body part. Furthermore, pressure and temperature-applying devices may be combined to also provide pressure and temperature sensations to a sensing body part. In addition, a force-applying device may be attached to a sensing body part and apply force to the sensing body part, where the force is applied relative to a reference location not rigidly affixed to the living body.